New York State

DEPARTMENT OF TRANSPORTATION

ENGINEERING RESEARCH AND DEVELOPMENT BUREAU

OPERATIONAL PLAN

DRAFT

JUNE 1988

OPERATIONAL PLAN

June 1988

DRAFT

ENGINEERING RESEARCH AND DEVELOPMENT BUREAU
New York State Department of Transportation
State Campus, Albany, New York 12232

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ENGINEERING RESEARCH & DEVELOPMENT BUREAU
MISSION STATEMENT

It is the mission of ER&D to manage a targeted engineering research and development program to enhance the quality and cost effectiveness of engineering policies, practices, procedures, standards and specifications. Activities performed to accomplish this mission include applied research, product evaluation, technical assistance, technology transfer and engineering consultation.

APPROVED: _____

DATE: 2/4/87

II. ENVIRONMENTAL/SWOT OVERVIEW

A. Environment

The completion of the interstate highway system and the aging of the overall transportation infrastructure has resulted in a shift in this Department's program emphasis from new construction to rehabilitation. This shift has also been experienced by virtually all state transportation and highway agencies and has resulted in a change in emphasis of transportation research programs.

This trend towards rehabilitation of the infrastructure has resulted in an increased need for research concerning management systems for structures, pavements, and other components of the highway system. Although the framework for such management systems can be generalized nationwide, extensive state development effort is required. For example, deterioration rates, which are dependent on past design, construction, and maintenance practices, as well as inspection methods and environmental conditions, are specific to each state and must be determined individually. Also, the trend towards larger and heavier trucks with higher tire pressures demands pavement research responsive to the conditions specific to the State's past design practices and construction materials.

New national and regional research programs such as SHRP (Strategic Highway Research Program) and UTC (University Transportation Center) complement rather than supplant state programs. State programs, due to limited resources, have traditionally focused on operational problems. The need for such studies will not be diminished and can be expected to increase as results from the new programs become available.

The Bureau's primary focus is 1) performing targeted research studies, and 2) evaluating new or modified techniques and products for the construction, maintenance, rehabilitation, and safety programs. The objective of this program is to assist the Department's program managers in attaining their units' goals.

B. Strengths, Weaknesses, Opportunities, Threats

The survey of senior management and clients performed by the Strategic Planning Bureau was instrumental in identifying many of the items listed here.

1. Strengths

- **Able and dedicated professional and support staff** -- Operational Goal 2 (OG-2).

- **Maintains state-of-the-art knowledge** -- OG-2 and OG-3. The Bureau maintains current awareness of technological and product developments in the engineering research field.

- **Good reputation inside and outside the Department as the producer of high-quality work** -- OG-1.

- **Adequate facilities** -- OG-2.

2. Weaknesses

- **Lack of formally defined communication with the Department's program managers relative to the establishment of the research program** -- Strategic Goal (SG-1) and OG-1.

- **Lack of a targeted Research Program** -- SG-1.

- **Uneven ability to manage** -- OG-2 and management issues. Due to lack of adequate supervisory staff and training.

- **Inadequate staffing pattern**. Ability to adjust staff to meet changing program needs is severely limited. While specialized engineering skills are highly developed in individual staff members, that skill is often limited to a single person whose loss can eliminate all expertise in a specialty. This problem is exacerbated by the low ratio of degreed to non-degreed engineering staff. To be addressed after completion of Strategic Goal 1.

- **Lack of an effective engineering research project tracking system** -- OG-4. Effective control of the program is needed to ensure that solutions to problems are provided in a timely manner.

3. Opportunities

- **Increased awareness among executive management and program managers of the Bureau's capabilities** -- OG-1.

- **Interest by management in having the Bureau develop a more effective technology transfer program** -- OG-1 and OG-3. Many innovations in methods, materials, and products can be evaluated and recommendations made for inclusion or exclusion in anticipation of or in response to program managers' needs and requests. A successful program is based on increased communication, mutual familiarity with operations, and executive management's backing in support of operating managers' goals.

- **Recognition by executive management of information needed to develop a relevant and effective engineering research program** -- SG-1. Although no research program can encompass all needs, the development of a targeted research program should focus limited resources on those problems most critical to this Department's success. Future additions to the research program might include such topics as expert systems, mechanistic pavement design and the support of bridge and pavement management systems.

- **Inclination of executive management to commit to change for the purpose of improvement** -- SG-1.

- **Potential for contracting out** -- SG-1. There is a perception that work can be done better, quicker, cheaper by consultants or universities.

4. Threats

- **Limited involvement in the engineering research program by executive management or program managers** -- SG-1.

- **Lack of implementation of research recommendations** -- SG-1. ER&D does not and should not have implementation responsibility. Nevertheless, implementation is a primary performance measure of successful research.

- **Perception that the Bureau is not cost-effective or productive** -- SG-1, OG-1, and OG-4. This perception could prove a detriment when attempting to institute positive changes.

- **Perception that Bureau is not responsive to client needs on a timely basis** -- OG-4.

- **Potential for contracting out** -- SG-1. There is a perception that work can be done better, quicker, cheaper by consultants or universities.

III. STRATEGIC AND OPERATIONAL GOALS

ENGINEERING RESEARCH AND DEVELOPMENT BUREAU
STRATEGIC GOAL

A. Strategic Goal #1: Program Development

Develop and implement a procedure to establish a targeted engineering research program. The procedure will be developed by 9/1/88 and implemented by 4/1/89.

APPROVED
IN CONCEPT: J E White

DATE: 4/12/88

Approval in concept is an interim approval which authorizes the preparation of a work plan. Goals will receive final approval when they are included in an approved Operational Plan supplemented by work plans for each goal included therein.

A. Strategic Goal 1: Program Development

2. Rationale

The Department's management wants assurance that the engineering research program is closely tied to and supportive of corporate goals. This involves defining broad research priorities and specific research programs within these areas. It also involves identifying research areas in which the Department should excel, recognizing that projects in other areas may more appropriately be accomplished by others. An ad hoc committee of regional and main office managers will be assembled to provide advice and comments at critical points in accomplishing this goal. Also, in cooperation with the Office of Strategic Planning and Management, visits to other state research organizations should be made. The information gained during such visits will be useful in accomplishing the Bureau's operational goals as well as this strategic goal.

Procedures will be developed to identify research needs of the Department's future program. In addition, it will be determined which of these will be solved by outside agencies (FHWA, NCHRP, SHRP, UTC, universities, consultants, other states, etc.), and which the Department will have to solve for itself. The in-house program should be concentrated in those areas of continuing interest to the Department to permit the development and retention of expertise. Methods will be developed to spot emerging trends and technologies on both state and national levels.

A standardized procedure will be developed to establish the appropriate funding level for research in the Department, to develop ranking criteria for selecting projects, and for assigning projects to staff, universities, etc. Also, this procedure will permit assigning resources to applied research, fundamental research, targeted technology transfer, and technical assistance.

An approved program development procedure will ensure that management has confidence in the decision-making process and the resulting program.

B. Operational Goal 1: Communications

1. Goal

Develop and implement effective methods to efficiently communicate the Bureau's current programs, available services, and accomplishments throughout the Department, and to improve communication of Department needs to the Bureau. Needs are to be identified by June 1988 and methods developed and implemented by March 1989.

2. Rationale

More effective communication is needed to support the Bureau's mission of enhancing the quality and cost-effectiveness of the Department's engineering activities. The Bureau must be aware of and responsive to Department needs. Conversely, to make effective use of the Bureau, all levels of the Department must be aware of the Bureau's current program, services available, and accomplishments. This will require clear and efficient two-way communication at the appropriate level of brevity or complexity.

C. Operational Goal 2: Staff Development and Recruitment

1. Goal

Develop a plan, in cooperation with the Office of Human Resources, for recruitment, development, and retention of professional and support staff appropriate to the Bureau's structure by March 1989.

2. Rationale

To provide useful services, the staff must be competent in both research methods and the engineering disciplines found in the Department. The "Physical Research" title structure assures a minimum level of research knowledge, but does not permit discrimination in professional staff selection among technical specialities. Because of the Bureau's small size, loss of a single person can have a significant short-term impact on its ability to perform research in a speciality area. In addition, promotions to engineering positions from the technician career ladder have resulted in an imbalance of non-degreed engineering staff. Efforts to correct this imbalance have resulted in loss of experienced technicians.

Accomplishing this goal will establish a systematic plan for staff recruitment and development, resulting in enhancement of the Bureau's capabilities and encouraging professional growth of its employees.

D. Operational Goal 3: Technology Transfer

1. Goal

Determine by September 1988 the benefits of an expanded effort by the Department in technology transfer and what the Bureau's role in that effort should be.

2. Rationale

Introduction of new concepts, techniques, and products from outside the Department now occurs largely as the result of the unmanaged initiatives of individuals and groups in response to needs of specific work assignments. There is no assurance that such efforts have either a high priority or focus on critical issues. As a result, potentially cost-effective innovations are missed because they are unknown or have no advocate. An exception is the technology transfer service now provided by the Bureau,

but this is limited to dissemination of Federal Highway Administration information and includes no mechanism for client feedback.

The goal will be achieved by developing a list of technology transfer options and potential benefits, an estimate of the resources required for each, and recommendations for implementation that include organizational and staffing implications.

Implementing the product of others' research may be extremely cost effective because it does not require investment of resources in the first instance, only access to that product and its critical evaluation.

E. Operational Goal 4: Program Management

1. Goal

Develop and implement a project tracking system to monitor and control the engineering research program by April 1989.

2. Rationale

To provide optimal transportation services within given funding constraints, the Department must take every feasible action to make its programs cost-effective and efficient. Continuously incorporating the results of a targeted research program into operating practice is one method of advancing this goal. Effective control and direction of research projects are necessary to ensure that problems are solved in a timely fashion. An effective project tracking system does not now exist.

In coordination with the Department's MIS and FMIS efforts, a project tracking system for the Bureau will be developed and implemented. This will be designed to monitor project schedules and expenditures, as well as work accomplishment and quality, to permit effective project control by Bureau management. In addition, research implementation will be monitored and the benefits achieved will be measured to permit evaluation of program effectiveness.

IV. ONGOING ACTIVITIES AND PERFORMANCE MEASURES

Key Ongoing Activities:

1. Conducting Research Projects

   The process by which improvements in the quality and cost effectiveness of some Department product or operation is achieved through directed scientific research.

2. Technology Transfer

   The process by which results of directed scientific research performed by others is used to improve the quality and cost effectiveness of Department products or operations.

3. Technical Assistance

   a. **Engineering Consultation**

      The process by which specialized knowledge and experience of the research staff is used by technical program managers to define and solve problems of modest scope, usually resulting in a client report.

   b. **Product Evaluation**

      The process by which new products, materials, equipment, and procedures are allowed to challenge existing products. This involves a scientific comparison of the attributes of the defender and the challenger.

   c. **Special Services**

      The process by which the Department's technical program managers acquire assistance in performing tasks that only Engineering Research can readily perform or the requestor program cannot easily perform. Examples are literature searches, statistical analysis, bridge load rating, instrumentation design and installation.

Performance Measures:

First, the performance measures for the effectiveness the engineering research program will be presented and then performance measures for the key activities will be presented.

Engineering Research Program Effectiveness:

Performance Measure -- The accumulated net benefits to Department products and operations resulting from formal engineering research projects divided by the annual engineering research expenditures. Both the benefits and expenditures will be aggregated over the last three fiscal years. This will be reported on a yearly basis.

Target -- To have this ratio exceed one.

Discussion

The benefits from formal research projects completed during the last three fiscal years will be accumulated. The benefits will be limited to a five-year span from the time of first implementation of the research results. This will be divided by the total research expenditure during the same period. The research expenditure will include all cost components -- Bureau, Department and outside contractors, and all key activities. This ratio compares relatively precise benefits resulting from work which was done previously to the current research effort. When this effectiveness measure exceeds one, it means that all of the research costs, from any source, are being completely covered by the benefits being provided by the formal research project portion of the research program.

This measure assumes a relatively stable research process. While the potential problems with this measure are readily recognizable, it appears to be a better measure than the obvious alternatives -- comparing current effort to anticipated cost improvements or comparing actual effort to actual cost improvements. The first alternative suffers from the fact that the anticipated cost improvements may never be realized at all. The second alternative requires a very complicated accounting system and has its own set of potential problems. Easily identifiable cost improvements resulting from consultation activities may also be included. Project benefits are not now routinely calculated or reported, nor does an accepted method of defining project benefits exist. Strategic Goal 1, Program Development, and Operational Goal 4, Program Management, will correct these deficiencies. Nevertheless, expenditure data are routinely available from the IAS.

1. Conducting Research Projects

Performance Measures

a. Satisfactory completion of the research project within the client-approved time and budget constraints. This will be measured by reporting the percentage over/under runs of the original research project duration and budget for completed projects and as the ratio of the percentage over/under runs, budget to time, for ongoing projects, similar to the effectiveness measures used for construction projects. The reporting cycle for ongoing projects will be quarterly. The reporting cycle for completed projects will be yearly.

b. The aggregate benefits and benefit cost ratio for projects completed in a fiscal year. The benefits will be limited to a five-year span from the time of first implementation of the research results. This measure will be reported on a yearly basis.

Discussion

The satisfactory completion of research projects is the primary means by which changes effecting the quality and cost effectiveness of Department product are made. Thus, it is important to monitor costs and lapsed time to ensure that orderly improvement of the Department's product stays on schedule. The performance measures imply that a dialogue between the researcher and client occurs so that a clear concept agreeable to both parties is arrived at concerning 1) the product to be delivered, 2) plans for the use of the product, 3) the feasibility of the research effort being successful, 4) the costs associated with the research effort and any necessary implementation steps, and 5) the expected benefits and the methods by which such costs and benefits will be measured.

Currently, the status of engineering research project schedules and costs is reported twice a year. However, in the past, no overt use of this data has been made by management to control either schedules or costs.

2. Technology Transfer

Performance Measures

The number of technology transfer attempts and dollar value of benefits to Department products or operations. These measures will be reported on a yearly basis.

Discussion

This process requires that Engineering Research maintains an aggressive program of acquiring, evaluating, and marketing the completed research product of other agencies. In some cases this activity will result in the programming of a formal research project and in others it will result in significant effort to adapt and implement the research results of others. Further refinements in measuring the performance of this activity may be possible after the completion of Operational Goal 3, Technology Transfer, and Operational Goal 4, Program Management.

3. Technical Assistance

a. **Engineering Consultation**

Performance Measure

Cost of the consultation services provided, reported on a yearly basis. In selected cases, it may be possible to easily measure the benefits resulting from this activity.

Discussion

The assumption underlying this measure is that if the service were not available from Engineering Research, an equivalent cost would be incurred for outside services. In selected cases, it may be possible to easily measure the benefits resulting from this activity. Further refinements in measuring the performance of this activity may be possible after the completion of Operational Goal 4, Program Management.

b. **Product Evaluation**

Performance Measure

The number of evaluations conducted and the dollar value of benefits to Department products or operations, reported on a yearly basis. Further refinements in measuring the performance of this activity may be possible after the completion of Operational Goal 4, Program Management.

Discussion

None.

c. **Special Services**

Performance Measure

Cost of the services provided, reported on a yearly basis.

Discussion

The assumption underlying this measure is that if the service were not available from Engineering Research, an equivalent cost would be incurred for outside services.

The following table shows how key ongoing activities and performance measures discussed on the previous pages could be displayed. Note that these are only example numbers.

We believe that the measures shown may be used by Department Management to effectively monitor and control the Research Program. However, it should be carefully noted that none of these measures addresses the fundamental questions of quality or the true worth of a well-conducted research program. These evaluations can only be supplied by a concerned and involved management.

	Year			
	One	Two	Three[2]	Total
Research Projects				
Numbers of Projects:				
Active Start of FY	34	32	30	
Completed in FY	6	5	15	
Added During FY	4	3	5	
For Completed Projects[1]:				
Ave. % Budget	195	113	101	
Ave. % Time	193	122	99	
Benefits ($ Million)	1.84	1.72	1.90	5.46
Project Benefit/Cost	2.14	2.64	3.00	
For Active Projects[1], [2]:				
Ave. % Budget/%Time	1.01	0.98	0.99	
Technology Transfer[2]				
Number	5	4	6	
Benefits ($ Million)	1	1	3	5
Engineering Consultation[2]				
Value to Department ($ Million)	0.5	0.4	0.5	
Benefits ($ Million)		1		1
Product Evaluations[2]				
Number	20	14	18	
Benefits ($ Million)	1	1	1	3
Special Services[2]				
Value to Department ($ Million)	0.5	0.3	0.4	
Cost of Research ($ Million)	2.8	2.5	3	8.3

Effectiveness Measure

Total Project Benefits/Total Research Cost = 5.46/8.3 = 0.66

Note: 1. Aggregate for all projects in this category during the fiscal year.

2. Statistics in these categories are not currently available, but will be in the future. The numbers shown are for illustration only.

V. RESOURCE REQUIREMENTS
STRATEGIC AND OPERATIONAL GOALS

Goal (completion date)	Personal Services (Person-Weeks) FY 1988-89	Personal Services (Person-Weeks) FY 1989-93	Other Than Personal Services ($) FY 1988-89
SG 1. Program Development (April 1989)	63	---	---
OG 1. Communications (March 1989)	30	1	---
OG 2. Staff Development and Recruitment (March 1989)	14	1	---
OG 3. Technology Transfer	40		---
OG 4. Program Management (April 1989)	18		---
Totals	165	2	---

RESOURCE DESCRIPTIONS

Personal Services

Goal	Skills/Functions Needed	Justifications	Time(Person -Weeks)	Source
SG 1.	Program management, funding, and research experience; information synthesis and report-writing expertise.	Need dedicated manager and researchers to develop program.	48 15	Existing staff; Ad hoc Committee*
OG 1.	Experience in analysis and development of questionnaires and in interviewing techniques.	Need experienced researchers to formulate optimum communication schemes.	30	Existing staff
OG 2.	Management and research experience, knowledge of Civil Service law, Training Bureau regulations, employee motivation skills.	Need experienced researchers, managers, and administrators for staff development.	12 1 1	Existing staff; Personnel Bureau; Training Bureau
OG 3.	Research experience; ability to synthesize technical information and prepare written material.	Need experienced researchers and editors to formulate technology-transfer program.	39 1	Existing staff; Ad hoc Committee*
OG 4.	Familiarity with project control methods and appropriate software.	Need dedicated managers, accountants, and administrators to develop and implement project tracking system.	18	Existing staff

* Same Membership

VI. MANAGEMENT ISSUES AND SUPPORT REQUIREMENTS

Management Issue 1

As a result of historical decisions made without strategic guidance, the Bureau's existing structure and professional skills are unsuited to deal with day-to-day needs of progressing a viable research program. For example, the New Jersey Department of Transportation (NJDOT) has a research organization similar in size and operating practice to that of New York. There, however, the percentage of professionals is about 80 percent, and each senior research professional is expected to handle about five research projects at the same time.

Using this example, Engineering Research (with about 60 current studies) should have about 12 Senior Civil Engineers engaged in progressing the research program. In fact, there are only six of these positions. This situation results in the following problems: a) it is difficult to properly supervise the remaining work force, b) succession planning for the research managers (Associate Civil Engineers) is difficult, and c) efforts of the research managers are misdirected to day-to-day operational problems. This situation is made worse by the fact that the proportion of professional staff in the Bureau is about the reverse of that in NJDOT.

The lack of professionals and adequate supervision means that the research managers have little time for proper planning and management of the research program. It also means that any additional responsibilities assigned to the research managers, such as direct involvement in operational problems, directly affects the schedule and quality of that research program.

Management Support Requirement 1

With concurrence and assistance of the Office of Engineering, Office of Human Resources, and Transportation Budgeting Bureau, explore the feasibility of assigning four to six additional Senior Civil Engineers and three to six additional Junior Engineers to the Bureau for a minimum of 2 years. Much of this can be accomplished within the existing personnel target level for the Bureau. This is an interim solution until the completion of Strategic Goal 1. At that time the issue of the Bureau's inadequate staffing pattern will be addressed. These additional positions should be normal Design and Construction titles to preserve long-term staffing flexibility.

Management Issue 2

The issue of implementing research results has not been seriously addressed by the Department. A number of promising research results have not been fully

implemented because of a lack of rational agreed-upon methods of comparing benefits and costs, institutional inertia, and modest problems occurring during initial implementation.

Management Support Requirement 2

Executive management must signal its desire to challenge existing practice in a search for improvement and program managers should be held accountable for the implementation of completed and accepted research results.

APPENDIX

Strategic Goal 1: Program Development

Operational Goal 1: Communications

Operational Goal 2: Staff Development and Recruiting

Operational Goal 3: Technology Transfer

Operational Goal 4: Program Management

STRATEGIC GOAL 1: PROGRAM DEVELOPMENT

I. GOAL AND RATIONALE

1. Goal

Develop and implement a procedure to establish a targeted engineering research program. The procedure will be developed by September 1988 and implemented by April 1989.

2. Rationale

Department management wants assurance that the engineering research program is closely tied to and supportive of corporate goals. An ad hoc committee of regional and main office managers will be assembled to provide advice and comments at critical points in accomplishing this goal.

Procedures will be developed to identify research needs of the Department's future program, which of these will be solved by outside agencies (FHWA, NCHRP, SHRP, other states, etc.), and which the Department will have to solve for itself. Methods will be developed to spot emerging trends and technologies on both state and national levels.

A standardized procedure will be developed to establish the appropriate funding level for research in the Department, to develop ranking criteria for selecting projects, and for assigning projects to staff or to contract research. These methods will also permit assigning resources to applied research, fundamental research, targeted technology transfer, and technical assistance.

An approved program development procedure will ensure that management has confidence in the decision-making process and the resulting program.

II. ACTION PLAN

A. Strategy

To provide a basis for Department management to approve the program development procedures resulting from this goal, selected regional and main office program managers will be formally involved in the action steps to achieve this goal. This involvement will require a limited amount of their time, but will provide a valuable resource to the goal team and will assure a broad consensus throughout the Department that all relevant issues have been properly addressed.

Six specific action steps that address the major issues of engineering research program development will be accomplished essentially in parallel.

Team members will keep in close contact throughout the process, due to the interrelated nature of these issues. The seventh step (creating the formal program development procedure) will begin at the same time as the other six, but will not enter its final phase until the other outputs are available. The schedule has been arranged to accommodate this need.

B. Action Steps

	Completion Date
1. Select program managers to participate in an ad hoc management committee, and involve them in the process.	6/1/88
a. Develop proposed list of main office and regional program managers and executive management.	
b. Prepare a memorandum to explain goal and invite participation. Include an initial questionnaire.	
c. Conduct initial meeting(s) to introduce managers to the process, acquaint them with their role, and discuss the work plan.	
d. Obtain initial input, categorize and analyze data, and provide to team members for use in subsequent steps.	
2. Develop method to link research to future Department program.	9/1/88
a. Identify existing and planned information on Department program projections.	
b. Identify significant documents, publications, meetings, and seminars on a national level to maintain current awareness about emerging issues.	
c. Identify research underway by FHWA, NCHRP, SHRP, other states, and other research organizations.	
d. Develop an annual procedure to project future program concerns, and the needed research response to them.	
e. Develop a procedure to obtain program and executive management comment and approval of the research effort for these emerging issues.	
3. Identify needed funding level for various levels of engineering research.	9/1/88
a. Synthesize literature concerning research expenditures by government and industry.	
b. Identify various benefits obtained from research and review past benefit/cost for the Bureau.	

		Completion Date
	c. Review distribution of research effort and identify program areas not currently served or served at too high a level. d. Review with ad hoc management committee and Management Systems Bureau. e. Review and project HPR and other potential funding sources. f. Formulate a recommendation to executive management.	
4.	Identify how to assign resources to applied research, fundamental research, technical assistance, and technology transfer. a. Survey and visit FHWA, other state DOTs, selected universities, and private sector corporations to find out how others address this issue. b. Obtain opinions and suggestions from the ad hoc management committee. c. Develop a rationale for appropriate breakdown and level of effort to be performed for each category. d. Formulate a recommendation to be acted on by executive management.	9/1/88
5.	Develop criteria for assigning resources to staff or contract. a. Identify critical issues for making such an assignment. b. Determine importance of each issue via contacts with other agencies, ad hoc management committee input, historical data, etc. c. Identify research organizations available to do research for the Department and what can be expected from them. d. Formulate a recommendation to be acted on by executive management.	9/1/88
6.	Develop ranking criteria for selecting research projects. a. Identify important criteria for ranking projects. b. Develop appropriate weighting factors for each criterion to be used in the ranking scale. c. Develop a formal procedure for using these criteria to rank projects and have the ad hoc management committee review it. d. Submit the final procedure to executive management for approval.	9/1/88

	Completion Date
7. Combine the outputs of the previous steps into a formal program development procedure and create a procedure for yearly approval.	4/1/89

a. Evaluate how other research agencies develop their programs and obtain management approval.
b. Set guidelines for formulating the research program reflecting all appropriate outputs from this and other goals.
c. Develop a procedure to identify, rank, and classify individual projects.
d. Develop a formal procedure to obtain executive management approval for the research program.
e. Obtain the Commissioner's approval of the guidelines and procedures developed in b, c, and d.

C. Schedule

Action Step	1988 A	M	J	J	A	S	O	N	D	1989 J	F	M
	1234	1234	1234	1234	1234	1234	1234	1234	1234	1234	1234	1234
1. Select managers	xxxx	xxxx										
2. Link research	xxxx	xxxx	xxxx	xxxx	xxxx	x						
3. Funding level	xxxx	xxxx	xxxx	xxxx	xxxx	x						
4. Designate resources	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	x					
5. Assign resources	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	x					
6. Ranking criteria	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	x					
7. Combine output	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx

D. Performance Measures

Quantity: Not Appropriate

Quality: The program development procedure should address all major issues which will be met if approved by department management without any substantive changes.

Timeliness: Final action step completed by 4/1/89.

Cost: Not Appropriate

STRATEGIC GOAL 1: PROGRAM DEVELOPMENT

III. ROLES AND RESPONSIBILITIES

A. Manager

M. W. Fitzpatrick -- Action Step 3

B. Team Members

J. G. F. Hiss -- Action Step 7

J. E. Bryden -- Action Steps 1 & 2

M. J. Loftus -- Action Step 6

G. L. Anania -- Action Step 5

T. F. Van Bramer -- Action Step 4

C. Organizational Linkage

Twelve to 15 Regional and Main Office Program Managers will be identified at the beginning of the work, and will need to devote a maximum of five person-days each for meetings and periodic reviews during the year of effort on this goal.

IV. RESOURCE REQUIREMENTS

PERSONAL SERVICES
(PERSON-WEEKS)

PERSON	ACTIVITIES	PERSON-WEEKS
Fitzpatrick, et al.	Manage goal, Action Step 3, liaison with other goal teams	12
Hiss, et al.	Action Step 7	15
Bryden, et al.	Action Steps 1 & 2	4
Loftus, et al.	Action Step 6	8
Anania, et al.	Action Step 5	4
Van Bramer, et al.	Action Step 4	5
Committee	Review work plan, provide suggestions on direction, review outputs	15

Total Resource Requirements (Person-Weeks): 63

STRATEGIC GOAL 1: PROGRAM DEVELOPMENT

V. MAJOR JEOPARDIES AND CONTINGENCY PLANS

1. Lack of agreement among or satisfactory participation by program managers on the ad hoc management committee concerning the Bureau's future direction.

   Contingency Plan: Non-functioning members will be replaced. Should the committee be unable to develop a consensus, the problem will be surfaced to executive management for resolution.

2. Some output from this goal will be recommendations of what is "best." Executive management could disagree with the final output.

   Contingency Plan: Executive management must be represented on the ad hoc management committee and have confidence in the other members.

3. Response from other agencies to questionnaires soliciting information could be poor.

   Contingency Plan: The agencies will be called to obtain responses, and some may be visited.

VI. MANAGEMENT ISSUE AND SUPPORT REQUIREMENT

1. Executive management will have to make it unmistakably clear that they support this effort and expect program managers and others to supply useful input.

2. The Commissioner is expected to provide final approval of the procedures developed by this goal before implementation begins.

OPERATIONAL GOAL 1: COMMUNICATIONS

I. GOAL AND RATIONALE

1. Goal

Develop and implement effective methods to efficiently communicate the Bureau's current programs, available services, and accomplishments throughout the Department, and to improve communication of Department needs to the Bureau. Needs are to be identified by June 1988 and methods developed and implemented by March 1989.

2. Rationale

More effective communication is needed to support the Bureau's mission of enhancing the quality and cost-effectiveness of the Department's engineering activities. The Bureau must be aware of and responsive to Department needs. Conversely, to make effective use of the Bureau, all levels of the Department must be aware of the Bureau's current program, services available, and accomplishments. This will require clear and efficient two-way communication at the appropriate level of brevity or complexity.

II. ACTION PLAN

A. Strategy

To make optimum use of the Department's engineering research resources and capabilities, it is necessary to establish and maintain effective two-way communication between the Department's administrators and/or program managers and the Bureau. To this end, some limited involvement by administrators and managers will be needed to establish a clear view of their perspective onf communications needs.

Four action steps have been defined to determine the level of communication with the Bureau that Department managers and administrators consider appropriate for their purposes, how well existing procedures meet these needs, what levels of communications and procedures are used by other states, and to make necessary adjustments and additions to those procedures.

OPERATIONAL GOAL 1: COMMUNICATIONS

B. Action Steps

	Completion Date
1. In cooperation with OSPAMS, develop questionnaires and establish a list of Department personnel to be surveyed, to determine communication requirements within the Department, using existing procedures as a base, and determine the comparable procedures used by other states.	5/31/88
2. Distribute questionnaires and current publications to selected personnel and to other states, and conduct follow-up interviews.	7/31/88
3. Evaluate responses to determine perceived management needs and the adequacy of existing procedures to satisfy those needs, and what (if any) changes to existing procedures are necessary, or if new procedures are warranted.	8/31/88
4. Effect identified changes, and develop and implement new communications procedures.	1/31/89
5. Monitor and/or systematically adjust procedures as needed.	3/31/89*

* Continuing basis, one person-week annually.

C. Schedule

	1988 M	A	M	J	J	A	S	O	N	D	1989 J	F	M
1. Develop questionnaires	X	X	X										
2. Surveys & follow-up interviews			X	X	X								
3. Evaluate survey responses					X	X							
4. Modify or develop procedures							X	X	X	X	X		
5. Monitor and adjust procedures													X*

* Continuing basis, one person-week annually.

OPERATIONAL GOAL 1: COMMUNICATIONS

D. Performance Measures

QUANTITY: Not Appropriate

QUALITY: The modified and/or new communications procedures should address both the identified requirements of administrators and program managers and of the Bureau.

TIMELINESS: Determine if Action Steps are proceeding on schedule and with anticipated resources.

COST: To be determined: Personal Service

III. ROLES AND RESPONSIBILITIES

A. Goal Manager

J.M. Vyce - Action Step 5

B. Team Members

J.E. Noonan - Action Step 4

F.P. Pezze - Action Step 2

N.J. Bruno - Action Step 1

E.W. Bikowitz - Action Step 3

C. Organizational Linkages

Consultation with the Office of Strategic Planning and Management Systems will be needed at all developmental stages included in the action steps. Some limited involvement of various Department administrators and program managers will be needed for the completion of the communications survey and for possible follow-up interviews.

OPERATIONAL GOAL 1: COMMUNICATIONS

IV. RESOURCE REQUIREMENTS

Personal Services
(Person-Weeks)

PERSON	ACTIVITIES	PERSON-WEEKS
Vyce, et al.	Goal Manager	2
Noonan, et al.	Action Step 4	6
Pezze, et al.	Action Step 2	3
Bruno, et al.	Action Step 1	8
Bikowitz, et al.	Action Step 3	5
Committee	Action Step 5	6
Total Resource Requirements (Person-Weeks):		30

Note: Approximately one person-week will be required to repeat Action Step 5 annually.

Additional fiscal resources will be required as appropriate to the identified communications concepts determined to be applicable.

OPERATIONAL GOAL 1: COMMUNICATIONS

V. MAJOR JEOPARDIES AND CONTINGENCY PLANS

1. Goal team members acquire other responsibilities that place constraints on the time available to pursue this goal.

   Contingency Plan: Replacement team members will be selected and coached to complete action steps under direction of remaining team members.

2. OSPAMS personnel may not be readily available when their advice and assistance are required.

   Contingency Plan: Reschedule subsequent action steps to coincide with availability of OSPAMS personnel.

3. Department personnel selected for survey may not have the time necessary to participate fully.

   Contingency Plan: Substitute personnel should be nominated from the next lower level of management within the appropriate program area.

4. Lack of sufficient fiscal resources appropriate to the identified communications concepts determined to be applicable.

   Contingency Plan: Adopt new or modified procedures on a more limited basis or, if that is not feasible, abandon those concepts and default to some less effective means of communication.

VI. MANAGEMENT ISSUES AND SUPPORT REQUIREMENTS

Department administrators, program managers, and users of implemented engineering research results must be involved in responding to the survey, agree to changes requiring additional resources, and demonstrate a willingness to use communications procedures resulting from their responses.

1. Management must participate as requested in the survey so results reflect their specific needs in maintaining an awareness of research activities.

2. If management has identified new procedures to communicate, they should support requests for fiscal resources to obtain the necessary equipment to develop these procedures.

3. Once communication procedures are tailored for specific needs, management should use them to maintain an appropriate level of awareness where research activities are concerned.

OPERATIONAL GOAL 2: STAFF DEVELOPMENT AND RECRUITMENT

I. GOAL AND RATIONALE

1. Goal

Develop a plan, in cooperation with the Office of Human Resources, for recruitment, development, and retention of professional and support staff appropriate to the Bureau's structure by March 1989.

2. Rationale

To provide useful services, the staff must be competent in both research methods and the engineering disciplines found in the Department. The "Physical Research" title structure assures a minimum level of research knowledge, but does not permit discrimination in professional staff selection among technical specialities. Because of the Bureau's small size, loss of a single person can have a significant short-term impact on its ability to perform research in a speciality area. In addition, promotions to engineering positions from the technician career ladder have resulted in an imbalance of non-degreed engineering staff. Efforts to correct this imbalance have resulted in loss of experienced technicians.

Accomplishing this goal will establish a systematic plan for staff recruitment and development, resulting in enhancement of the Bureau's capabilities and encouraging professional growth of its employees.

II. ACTION PLAN

A. Strategy

Participation from all levels of Bureau employees will be sought to assure that the plan satisfies administrative needs and encourages professional growth. Assistance of the Office of Human Resources will be solicited to ensure that all Department resources are fully exploited in execution of this plan.

B. Action Steps

1. Identify common skill requirements for fundamental research activities. Section heads and key supervisors will be surveyed.

2. Survey employees' skills and training needs and desires. Each employee will be asked to rate his skills against the common skill needs.

OPERATIONAL GOAL 2: STAFF DEVELOPMENT AND RECRUITMENT

3. Determine skill requirements and employee development policies of a sample of other research organizations. Conduct a telephone survey of not more than five other organizations.

4. Identify immediate training needed for employees to meet the common skill requirements of their Civil Service grade levels. Results of Steps 1, 2, and 3 will be integrated to accomplish this action step.

5. Determine appropriate available training options to best satisfy the identified training needs. Available training options are as follows:

    a. Formal training (institutional),

    b. Seminars and/or short courses:

        1) Training Bureau,

        2) Outside,

    c. Staff rotation, and

    d. Internal (Bureau) orientation,

6. Develop a recruiting plan to ensure appointment of the most qualified candidates. Prepare uniform recruiting packets by title containing consistent descriptions of duties and job responsibilities.

7. Identify management policies and procedures to encourage stability of the Bureau's skills pool. Methods of employee motivation will be examined.

8. Coordinate identified training needs and options and develop a Bureau training program.

9. Implement Bureau training plan that will assure the development and maintenance of necessary skills and encourage individual professional growth.

C. Schedule

See Attachment A.

D. Performance Measures

1. Complete staff development and recruiting plan on schedule and within budget.

OPERATIONAL GOAL 2: STAFF DEVELOPMENT AND RECRUITMENT

2. Proportion of adequately trained employees exceeds 95 percent.

3. Basic skill levels attained within 6 months of identification of need.

4. Specialized skills maintained by at least two employees.

III. ROLES AND RESPONSIBILITIES

A. Manager

D. B. Beal

B. Team Members

K. C. Hahn
J. A. Burnett
M. E. Doody
Y. H. Mathias
D. A. Frederick
W. C. Hadersbeck

C. Organizational Linkages

Training Bureau
Personnel Bureau

IV. RESOURCE REQUIREMENTS

See Attachment B.

V. MAJOR JEOPARDIES AND CONTINGENCY PLANS

A. Major Jeopardies

1. Skill requirements identified in Action Step 1 may conflict with Civil Service standards for some titles.

2. Training funds may be inadequate to meet needs.

B. Contingency Plans

1. Close coordination with Department Personnel Bureau for early identification of potential conflicts.

2. Use budget process to increase funding. Replace outside training with in-house resources.

OPERATIONAL GOAL 2: STAFF DEVELOPMENT AND RECRUITMENT

VI. MANAGEMENT ISSUES AND MANAGEMENT SUPPORT REQUIREMENTS

None

ATTACHMENT A

SCHEDULE FOR OPERATIONAL GOAL 2: STAFF DEVELOPMENT & RECRUITMENT

	1988									1989		
ACTION STEP	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR
1. Identify Common Skill Requirements	XXX											
2. Survey Employee Needs/Desires		XXXXXXXXXXX										
3. Survey Other R&D Programs	XXX											
4. Identify Training Needs		XXXXXXXXXXX										
5. Identify Training Options			XXXXXXX									
6. Standardize Recruiting Policy			XXXXXXXXXXXXXXXXXXXXXXXXXXX									
7. Identify Motivators	XXXXXXXXXXXXXXXXXXX											
8. Coordinate Needs and Options & Develop Training				XXXXXXXXXXXXXXXXXXXXXXXXXXX								
9. Implement Program									XXXXXXXXXXXXXXX			

ATTACHMENT B

RESOURCE REQUIREMENTS FOR
OPERATIONAL GOAL 2: STAFF DEVELOPMENT & RECRUITMENT

Personal Services
(Labor in person-weeks)

Personnel	Explanation	FY 1988-89
Goal Manager		
- D. B. Beal	o Manage Plan Preparation; o Yearly Revision	2.0 weeks
Team Members		
- K. C. Hahn	o Survey Needs o Recruiting	3.0 weeks
- J. A. Burnett	o Recruiting	1.0 week
- M. E. Doody	o Training Needs o Motivations	1.0 week
- Y. H. Mathias	o Telephone Survey o Recruiting	2.0 weeks
- D. A. Frederick	o Training Options	1.0 week
- W. C. Hadersback	o Data Analysis	2.0 weeks
Other Personnel:		
- Personnel Bureau	o Recruiting	1.0 week
- Training Bureau	o Training Options	1.0 week
Total Personnel Services:		14.0 weeks

Note: It will require ONE PERSON-WEEK/YEAR to maintain Action Step 9.

OPERATIONAL GOAL 3: TECHNOLOGY TRANSFER

I. GOAL AND RATIONALE

1. Goal

Determine by September 1988 the benefits of an expanded effort by the Department in technology transfer and what the Bureau's role in that effort should be.

2. Rationale

Introduction of new concepts, techniques, and products from outside the Department now occurs largely as the result of the unmanaged initiatives of individuals and groups in response to needs of specific work assignments. There is no assurance that such efforts have either a high priority or focus on critical issues. As a result, potentially cost-effective innovations are missed because they are unknown or have no advocate. An exception is the technology transfer service now provided by the Bureau, but this is limited to dissemination of Federal Highway Administration information and includes no mechanism for client feedback.

The goal will be achieved by developing a list of technology transfer options and potential benefits, an estimate of the resources required for each, and recommendations for implementation that include organizational and staffing implications.

Implementing the product of others' research may be extremely cost effective because it does not require investment of resources in the first instance, only access to that product and its critical evaluation.

II. ACTION PLAN

A. Strategy

Technology transfer will be defined in the broadest terms possible, consistent with common usage in the transportation industry, and consensus sought within the Department on that definition. Program options will be identified that complement existing efforts and that are compatible with the experimental program. Advice will be sought from resource persons both in and outside the Department. Recommendations will be made to the Strategic Goal 1 team.

OPERATIONAL GOAL 3: TECHNOLOGY TRANSFER

B. Action Steps

		Completion Date
1.	Develop a clear and concise definition of technology transfer.	4/01/88
2.	Seek consensus on the definition developed in Action Step 1 by engaging input from the program development ad hoc committee (Action Step 1 of Strategic Goal 1).	5/01/88
3.	Survey current technology transfer programs and literature, and prepare a list of technology transfer options.	6/01/88
4.	From among the options identified in Action Step 3, identify those consistent with the Bureau's mission and not already being done elsewhere in NYSDOT or by other state agencies.	7/01/88
5.	Determine as quantitatively as possible the costs and benefits of options identified in Action Step 4 and the clients to be served.	8/01/88
6.	Recommend to the Strategic Goal 1 team those technology transfer options offering optimal benefits to the targeted audiences.	9/30/88

C. Schedule

		M		A		M		J		J		A		S	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1.	Define technology transfer	XX															
2.	Consensus			XXXX													
3.	List options	XXXX		XXXX		XXXX											
4.	Screen options						XXXX		XXXX								
5.	Costs/Benefits/Clients								XXXX		XXXX						
6.	Recommend and report												XXXX		XXXX		

OPERATIONAL GOAL 3: TECHNOLOGY TRANSFER

D. Performance Measures

QUANTITY: Not appropriate

QUALITY: Recommendations supported

TIMELINESS: Completion of recommendations and report by September 30, 1988

COST: Not appropriate

III. ROLES AND RESPONSIBILITIES

A. Goal Manager

W.P. Chamberlin -- Action Steps 2 & 6

B. Team Members

A.B. Tyrell -- Action Step 5

P.K. Gupta -- Action Steps 3 & 4

A.D. Emerich -- " "

T.M. Bohl -- Action Step 1

R.M. Pyskadlo -- " "

C. Organizational Linkages

1. Other Department program managers will be involved in Action Step 2.
2. Liaison with Strategic Goal 1 team will be maintained.

OPERATIONAL GOAL 3: TECHNOLOGY TRANSFER

IV. RESOURCE REQUIREMENTS

PERSONAL SERVICE
(PERSON WEEKS)

PERSON	ACTIVITIES	PERSON-WEEKS
Team Manager		
Chamberlin	Consensus	1
et al.	Recommendations & Report	5
Team Members		
Bohl/Pyskadlo, et al.	Define technology transfer	3
Emerich/Gupta et al.	List & screen options	20
Tyrell, et al.	Costs/Benefits/Clients	10
Other Personnel		
Strategic Goal 1 Ad Hoc Committee	Consensus	1
TOTAL RESOURCE REQUIREMENTS (PERSON-WEEKS)		40

OPERATIONAL GOAL 3: TECHNOLOGY TRANSFER

V. MAJOR JEOPARDIES AND CONTINGENCY PLANS

1. An expanded technology transfer program may be negatively perceived:

   a. As a threat (an encroachment on existing responsibilities of others),

   b. As a nuisance (the source of a barrage of irresponsible suggestions requiring response), or

   c. As empire-building (an excuse to expand staff and influence for its own sake).

   Contingency Plan: This will include interaction with the program development ad hoc committee as a means for building consensus for the recommendations and for addressing the issues raised.

2. Because the term "technology transfer" conveys different meanings to different persons, there is a risk that once the Goal 3 task is completed, recommendations will be rejected because they are perceived as outside its scope. The approved Goal and Rationale statements are not sufficiently explicit to preclude this possibility.

   Contingency Plan: Action Step 2 has been included specifically to reduce the risk described by this concern. Completion of Action Steps 3 and 4 will be deferred until a broad consensus is developed on the definition and scope of technology transfer developed under Action Step 1.

3. Upper-level management could decide that a new and improved technology transfer program would eliminate the need for an experimental program.

   Contingency Plan: The Goal Team currently believes the definition of technology transfer developed under Action Step 1 should and will include the following concepts:

   a. Some innovations adopted from others will require experimental validation in New York,

   b. Research staff will have a responsibility to provide resources to assist with implementation of innovations recommended, and

   c. New York has a responsibility to contribute original research to the pool of new technology from which it benefits. These considerations will require a continuing experimental program.

OPERATIONAL GOAL 4: PROGRAM MANAGEMENT

I. GOAL AND RATIONALE

1. Goal

Develop and implement a management information system to monitor and control the engineering research program by April 1989.

2. Rationale

To provide optimal transportation services within given funding constraints, the Department must take every feasible action to make its programs cost-effective and efficient. Continuously incorporating the results of a targeted research program into operating practice is one method of advancing this goal. Effective control and direction of the research program are necessary to ensure that problems are solved in a timely fashion. An effective management information system does not now exist.

In coordination with the Department's MIS and FMIS efforts, a management information system for the Bureau will be developed and implemented. This will be designed to monitor project schedules and expenditures, as well as work accomplishment and quality, to permit effective project control by Bureau management. In addition, research implementation will be monitored and the benefits achieved will be measured to permit evaluation of program effectiveness.

II. ACTION PLAN

A. Strategy

Develop a system, in cooperation with the MIS and FMIS task groups and the Finance Division, that will support effective project management and reporting of performance measures, and allow for the measurement of research benefits.

B. Action Steps

1. Monitor and Control Project

1. Develop and obtain internal and FHWA approval for a reporting format to monitor and control project schedules and expenditures by March 11, 1988.

2. Implement the agreed reporting format, and by May 20, 1988, produce the first quarterly report based on costs as of March 31, 1988.

3. Review the first quarterly report, make necessary changes in format, set up a system for routine production of subsequent quarterly reports, and produce the second quarterly report by August 19, 1988.

4. Complete system documentation and issue instructions to staff regarding needed maintenance to keep the system database current by October 21, 1988.

5. Complete discussions with FMIS staff regarding transfer of the Bureau system to the mainframe by January 31, 1989. Issues to be discussed are timing, corporate information needs not yet addressed in the Bureau's information system, and the feasibility of having the mainframe system handle the entire project reporting system.

6. Implement and document changes to the reporting system resulting from the first year's experience and discussions with FMIS staff, and obtain approval of the final system from FHWA by April 1989.

7. Make necessary modifications to the Bureau's function codes to support the new project monitoring and control system and the performance measures for on-going activities by April 1989.

2. Measure Work Accomplishment and Quality

1. To increase the emphasis on work accomplishment and product quality, reassign existing administrative duties of the Assistant Director of Research to the Bureau's new Administrative Assistant. To stress the importance of this action the Assistant Director will be relocated among the engineering research staff. Both steps will be accomplished by May 1988.

2. Devise guidelines for conduct of various research activities by September 29, 1988. These guidelines will cover formal research projects, technology transfer, engineering consultation, product evaluation, and special services. The guidelines will specify for each activity the appropriate phases, control points, and products or attributes to measure and determine accomplishment and quality.

3. Devise reasonable methods to measure accomplishment and quality for the products and attributes identified in Action Step 2 by November 30, 1988.

4. Incorporate the results of Action Steps 2 and 3 in a policy guidance

manual for the conduct of research activities by April 1989.

5. Implement the results of Action Steps 2 and 3 in all on-going research activities by April 1989.

3. Implementation and Benefits

1. Devise methods and procedures for managing implementation of research results by September 1988. These methods and procedures will take into account the relative complexity and risk associated with the research result to be implemented, and provide for means to measure success of the implementation effort. Provisions will exist to provide any needed feedback to operating units for the fine-tuning needed for complete operational use.

2. Devise methods and procedures for quantitatively and qualitatively measuring the benefits of implemented research results by January 1989.

C. Performance Measures

Quantity: Not Appropriate.

Quality: A reduction in schedule and budget variances and improvement of product quality.

Timeliness: Each of the 14 separate action steps will be completed on time.

Cost: Not Appropriate.

III. ROLES AND RESPONSIBILITIES

A. Manager

R. Perry

B. Team Members

F. Hiss, D. Riede, J. Disbro, and other Bureau staff as needed.

F. Hiss will be responsible for development and implementation of methods to measure work accomplishment and quality.

D. Riede will be responsible for development and implementation of the system to monitor and control project schedules and expenditures.

J. Disbro will be responsible for developing methods and procedures to manage the implementation phase of research results and to measure the benefits achieved.

OPERATIONAL GOAL 4: PROGRAM MANAGEMENT

C. Organizational Linkage

1. Develop liaison with MIS and FMIS task groups to ensure that Bureau and Department information systems are properly coordinated.

2. Develop liaison with managers for Strategic Goal 1 (Program Development) and Operational Goal 1 (Communications) and various Division directors to determine acceptable definitions for quality of various research efforts.

3. Develop liaison with the Finance Division to determine acceptable measures and methods for determining the benefits of implemented research results.

IV. RESOURCE REQUIREMENTS

The effort needed to accomplish this goal can be supplied without undue disruption to existing Bureau functions. It is estimated that each person involved in this goal will devote about 10 person-weeks to the goal accomplishment effort.

V. MAJOR JEOPARDIES AND CONTINGENCY PLANS

A. Major Jeopardy

Although most of the effort required to accomplish this goal is internal to the Bureau, successful conclusion of this goal will require substantial amounts of time from high-level operating personnel to ensure that the Bureau's perception of quality, timeliness, and benefits are consistent with theirs.

B. Contingency Plan

Without the necessary access, some of the completion times may have to be extended.

VI. Management Issues and Management Support Requirements

The issue of implementing research results has not been seriously addressed by the Department. A number of promising research results have not been fully implemented because of lack of a rational agreed-upon method of comparing benefits and costs, institutional inertia, and modest problems occurring during initial implementation. Executive management must signal their desire to and insistence on having research results incorporated into operating practice.

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